Future Business Journal

RESEARCH Open Access

The moderating role of personalized recommendations in the trust–satisfaction–loyalty relationship: an empirical study of AI-driven e-commerce

Noha Hassan[1*], Mohamed Abdelraouf[2*] and Dina El-Shihy[1*]

Abstract

Purpose This study investigates the effects of trust, satisfaction, and loyalty on AI-driven e-commerce, with a particular focus on how personalized recommendations moderate these relationships. It aims to explore how personalized AI features reshape consumer perceptions and decision-making.

Design/methodology/approach A quantitative research approach was used to collect data from a diverse group of e-commerce users who had interacted with AI-based recommendation systems. An online survey employing standardized scales for trust, satisfaction, loyalty, and personalization was administered, and data were analyzed using structural equation modeling (SEM) to test the hypotheses.

Findings The study reveals that trust has a significant positive influence on both satisfaction and loyalty. Personalization further strengthens these relationships by moderating the trust–satisfaction–loyalty dynamic. Satisfaction partially mediates the relationship between trust and loyalty, with the model's explanatory power improving by 5% when personalization is included as a moderator. These results highlight the pivotal role of personalized recommendations in shaping consumer trust and satisfaction in AI-driven e-commerce.

Practical implications Businesses can use personalized recommendation systems to enhance trust and satisfaction, thereby fostering loyalty. For example, platforms like Amazon and Netflix have successfully employed personalized AI algorithms to boost customer retention and engagement. Transparency features, such as explaining why certain products are recommended, and cultural sensitivity in algorithm design can further enhance customer trust and acceptance. e-commerce organizations should also invest in data privacy measures and clear algorithms to maintain consumer confidence while leveraging AI to improve customer experience and achieve sustainable competitive advantages.

Originality/value This study contributes to the growing body of knowledge on AI-driven e-commerce by demonstrating how personalized recommendations influence trust, satisfaction, and loyalty. It provides actionable insights for leveraging AI tools to build stronger consumer relationships in dynamic digital marketplaces.

*Correspondence:
Noha Hassan
Noha.hassan@ngu.edu.eg; N.ahmed@aucegypt.edu
Mohamed Abdelraouf
mohamedabdelraouf04@gmail.com
Dina El-Shihy
elshihy.dina@ngu.edu.eg

Keywords AI-driven e-commerce, Artificial intelligence, Chatbot, Customer experience, E-commerce, Loyalty, Online shopping behavior, Personalization, Personalized recommendations, Satisfaction, Trust

Introduction

The e-commerce environment is inherently dynamic [1, 2], necessitating a deeper understanding of the interplay between trust, satisfaction, and loyalty among online consumers. Advancements in artificial intelligence (AI), particularly in recommendation systems, have significantly reshaped consumer behavior. AI-powered tools such as chatbots, personalization, and predictive analytics are transforming how consumers interact with online platforms, influencing their satisfaction, trust, and loyalty.

This study is motivated by the growing need to explore these interrelationships within the context of AI-driven e-commerce systems [3–5]. Specifically, the application of AI-based personalized recommendations introduces new dynamics into consumer decision-making, necessitating an investigation into how trust mediates loyalty and how satisfaction influences this relationship. Understanding these interactions is essential for businesses seeking to leverage AI tools to build lasting relationships with their customers.

Given the increasing reliance on personalized recommendation systems as a key AI application in e-commerce [6], this study examines the trust–satisfaction–loyalty relationship. By focusing on personalized recommendations as a moderating factor, this research investigates how trust impacts customer satisfaction and loyalty in AI-powered digital marketplaces. The findings offer both theoretical and practical contributions to the field of consumer behavior. Theoretically, this study enriches the literature on how AI-based systems influence customer perceptions, trust, and loyalty. Practically, it provides actionable insights for e-commerce practitioners to strategically deploy AI tools such as personalized recommendations to enhance customer trust, satisfaction, and loyalty.

This research seeks to answer the following key question: How does trust affect customer satisfaction in AI-driven e-commerce, and how does the use of personalized recommendations moderate the trust–loyalty relationship? This inquiry provides a comprehensive understanding of how trust, satisfaction, and loyalty interact within AI-driven ecosystems, highlighting both opportunities and challenges in using AI features like recommendation systems. These insights are critical for businesses aiming to design customer-centric strategies in today's digital marketplaces [7].

Literature review

Trust–satisfaction–loyalty relationship

In the context of e-commerce, the role of trust and loyalty is essential, which shows the level of consumers' engagement with sellers or online platforms [8]. Trust can be defined as the consumers' belief in the seller or the platform that they can deliver or promise, and the way they address concerns and complaints in the online environment. It is a significant factor in building concepts, and enhancing the consumer's tendency to transact, disclose personal information, and make repeated business [9, 10]. On the other hand, loyalty is the consumers' attitude toward a particular online seller or the platform, driven by their satisfaction and the bonds they have developed with the seller [11]. The factors that significantly affect loyalty of consumers in e-commerce are service quality, product quality, price, innovation, and convenience since they collectively define the total experience of shopping for products online and customers' satisfaction [12, 13]. Factors such as service quality, product quality, price competitiveness, innovation, and convenience affect satisfaction and loyalty in e-commerce [14, 15].

As such, artificial intelligence features such as recommendation and chatbots help to improve trust, satisfaction, and loyalty within the e-commerce system [16]. Recommendations generated through artificial intelligence are much more beneficial for the customers as it makes shopping more personalized and provides the customer what they are looking for, thereby increasing the level of satisfaction. In addition, the use of AI, particularly through chatbots and virtual assistants, has also been found to enhance customer service, particularly, in addressing complaints and inquiries from the customers and ensuring that the customers are satisfied [17]. Furthermore, it was also noticed that the application of the AI-based functions in the different procedures and activities leads to making the process more efficient and satisfactory. Thus, through the implementation of different processes in the online shopping process, including payment and order delivery, AI optimizes the customers' experience and makes it more efficient [12].

A review has been made on the previous studies focusing on the three aspect of e-commerce; trust,

satisfaction, and loyalty and how it has been shifted with the emerging of AI technologies. Sophisticated present-day IT and AI solutions have revolutionalized ways in which organizations deal with customers needs hence enhancing a more pro-active approach to the shopping experience [18]. Advanced arithmetic and statistical analysis and machine learning can accurately anticipate customer's behavior and expectations, and thus, customer relations can be made interesting and closer to reality through advanced business technologies. This level of personalization not only makes the customer gain more confidence in the e-commerce platform because they feel they are valued by it [19].

Secondly, the application of AI in e-commerce has transformed customer relationship management as aspected by businesses [20]. Through analyzing the customers recently involved in their business, their purchasing behavior, and feedback that could be negative to the business, companies can find the real problems as they begin to develop and provide precise solutions that will ensure that the company's customers continue to rate it highly. Many organizations understand emphasize on customer needs pro-active approach has become imperative in the management of long-term customer relations. They feel that this approach not only serves to increase the level of satisfaction that customers feel toward the company's products, but also creates a solid base for an emotional bond between the customers and the brand, and as such customers are more likely to be loyal [21].

This is because the capabilities in AI also have been progressively improving over the years and that has also allowed e-commerce platforms to provide better and more authentic services to users. This has led to better customer transaction protection through advanced fraud detection systems as well as intelligent product order inventory systems that make goods available to consumers. The enhancements aimed at service reliability and security contribute to developing a positive feedback loop when higher trust results in higher satisfaction and consequent customer commitment. Increasing credibility of the AI technology, the application of its key tenet of establishing trust–satisfaction–loyalty triangle in e-commerce is expected to become even more prominent in future strategic formulation of e businesses [22].

Therefore, it is imperative to gain insights into the extent of trust, loyalty, satisfaction, and AI features in digital business environments. By integrating the artificial intelligence capabilities, organizations can improve the customization, customer service, and productivity, thus creating a better bond with the customers and achieving business goals [23, 24].

The mediating role of satisfaction

The literature review on e-commerce has established that trust is a significant determinant of loyalty with guidance from the Trust-Commitment Theory and Relationship Marketing Theory [25, 26]. According to the trust theory, trust is the foundation of any long-lasting business relationship that can lead to repeat business and brand loyalty. Several analyses have established that website quality, security, customer service, and perceived value are the main factors influencing trust and loyalty in e-commerce [27]. Satisfaction is a mediating factor between trust and loyalty, as it bridges the gap between expectation and perceived performance by the consumer as postulated by Khan et al. [28]. When the expectations of the customers are fulfilled or even surpassed, it leads to increased customer satisfaction, and this in turn leads to customer loyalty [29].

Khan et al. [28] also postulated that customer satisfaction is the mediator between customer relationship management and the company's reputation and customer loyalty. This research aims to meet the objectives of increasing customer satisfaction, improving the company image, and creating excellent customer relationship management to promote customer loyalty. This study aims to examine the impact of personalized recommendations from an AI chatbot on the trust–satisfaction–loyalty model. It provides implications for e-commerce firms that are integrating the AI elements in their business with the aim of improving customer satisfaction and participation [30, 31]. These earlier studies did not directly look at how satisfaction might affect the relationship between trust and loyalty when AI chatbots are personalized. This is why the current study is important and relevant [32].

This research responds to the call for more study on the satisfaction mechanism by exploring the role of satisfaction in the trust–loyalty context. This is due to the fact that it enriches the general understanding of e-commerce relationships in particular with regards to the AI-based aspects [33].

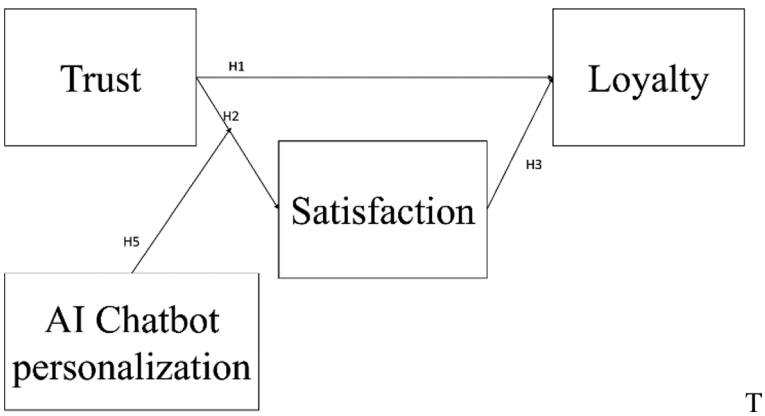
The moderating role of personalized recommendations

AI's capability of providing personalized and customized service increases the effect of trust on satisfaction and loyalty through providing recommendations that meet the consumers' needs and preferences [34, 35]. Nevertheless, the level of perceived transparency and explainability of the AI systems can affect this relationship. If consumers perceive the AI as black box and do not understand how it arrives at certain decisions, trust may not automatically result in satisfaction [36]. On the other hand, when customers consider AI as helpful and trustworthy, this enhances the relationship between

trust and satisfaction consequently increasing loyalty [34]. The mediating role of AI interventions that help in increasing transparency, usefulness, and credibility of the system helps to moderate the relationship between trust and satisfaction and flows to loyalty [37]. However, if the AI systems do not perform to the expectations of the users, they may reduce the effect of trust on satisfaction [38]. Businesses that adopt AI chatbot personalization must consider these moderating effects to improve consumer engagement [39]. However, the negative consequences of AI implementation or the users' negative perception of the system may weaken the positive effects of trust on satisfaction and loyalty, and therefore, it becomes crucial to understand how the use of AI-based recommendation systems affects these relationships [30, 31] This is the case because, being new concepts, there is not enough literature on the roles of AI and other associated technologies in e-commerce [40]. The prior research has mainly examined the accessibility, usage, perceptions, and effects on satisfaction and trust toward AI [41]. Further studies could assess the impact of AI chatbot personalization and how it can reduce this gap in the future using structural equation modeling [42]. Furthermore, as Prentice et al. [43] suggest, the use of many datasets, methods, and metrics can help to understand the moderating roles of the AI technologies. The potential of using artificial intelligence in business to improve customer relations has been discussed in this paper. However, it is still unclear to what extent AI influences the chain of trust–satisfaction–loyalty and to what extent this varies depending on the type, quality, and context of the AI-based interventions. Expanding this study area will help in understanding the implications of AI on platform performance and customers' behavior online [44].

Summary of the literature review

The literature also stress of effect of trust, satisfaction, and loyalty in the e-commerce discussing further the reciprocities of the factors and how AI can facilitate the factors. Trust concerns with promises made and issues regarding a platform in consumers' mind is the most basic attribute that that factors into satisfaction and loyalty. Duration or length of customer loyalty in e-commerce can be determined by service quality, product quality, innovation, and convenience. Personalization applications and chatbots are among the AI technologies that have transformed customer experiences in that they have streamlined a number of processes, solved problems that affect customers individually, and built customer trust through such factors as transparency and security. All these advancements enhance this trust–satisfaction–loyalty model, which is a key for e-commerce business. However, the success of these AI systems relies on the consumer experience; therefore, other factors like perceived system transparency can be a cause of concern since they result in reduced satisfaction. However, there are still some gaps in the existing literature that this research will make an effort to address regarding the roles of trust, satisfaction, and loyalty. The research gap now comes in the form of understanding the role that more personalized AI features like chatbots play in the trust–satisfaction–loyalty relationship and as moderating variables. Moreover, the prior research mainly ignores how these effects may differ depending on the form, the quality, and the environment of AI applications. This has left a very important knowledge gap on how AI technologies are affecting consumer behavior and platform performance in different contexts. It is crucial to fill these gaps to better understand what possibilities of AI use in e-commerce improve customer relationships and what



T

Fig. 1 Conceptual framework. *Source*: Developed by the Authors

potential contribution to e-commerce strategies. Therefore, the suggested research model is as follows:

In light of extant literature, the proposed model (Fig. 1) shows how AI chatbot personalization influences the relationship between trust and loyalty as a moderator variable. In the proposed model, the level of personalization during the interaction with AI chatbot is the determinant of the level of trust in the specific service provider, which in turn affects the customer's loyalty intentions as satisfaction variable mediates the relationship between trust and loyalty. Thus, this work attempts to provide a theoretical framework for this model in order to help explain the contribution of AI chatbot personalization in increasing customer trust and, consequently, loyalty. The reason why AI chatbot personalization has the impact toward the level of trust can be explained by Social Presence Theory. Based on previous findings, responses that are most believable and involve a clear human-like social presence occur when chatbots present the behaviors of specific personalities or individuals. This increased social presence leads to the formation of trust as users' overall perceived the interaction is more real and compassionate. According to the theory, it is proposed that where technology could mimic social relationships, customer begins to establish confidence in the service provider.

It is explicable based on the Information Processing Theory in the context of the moderating role of the personalization of the AI chatbot concerning trust. When chatbots provide personalized responses based on user preferences and past interactions, they reduce cognitive load for users by presenting relevant, contextualized information [45]. For this reason, this streamlined information processing can be said to fortify the trust–loyalty relationship because users feel that the parties are paying attention to their requirements. The moderating relationships of satisfaction between trust and loyalty are in par with Expectation-Confirmation Theory [46]. Whenever users can rely on an AI chatbot because of individualization, they have specific expectations regarding the service. When all these expectations are met or surpassed through individual communication, satisfaction results. That satisfaction then becomes an important link to loyalty because the customers' that are satisfied will stay and continue to patronize the service provider.

The overall framework can therefore be conceptualized within Relationship Marketing Theory within which customer relations are nurtured for the long haul. AI chatbot personalization makes it possible to apply relationship marketing concepts because it provides unique customer experiences to bolster trust. As a result of being understood this form of trust on the part of the customer or client is likely to result in higher levels of loyalty since the customers feel valued.

The intimate connection between trust and loyalty can also be discussed based on the TAM perspective. Whenever users find the AI chatbots as functional and easy to use, it strengths the consumers' confidence on the AI used. The first is the new perceived trust from increased online interactions; the other depends on perceived satisfaction from prior positive interactions and puts into place the technology acceptance for the expected loyalty to the particular service provider.

In this context, Self-Determination Theory is used to explicate the relationship between personalization and trust and, in turn, personalization and loyalty. Personalized chatbot communication can satisfy users' fundamental psychological needs of self-A (control of the interaction), self-C (acquisition of relevant assistance), and self-R (asset of individualized consideration). It also improves loyalty and trust when these needs are fulfilled out of the reward received for the loyal behavior. Hence, the direct relationship between trust and loyalty should be considerable because when customers trust an organization, they experience less risk and uncertainty about service encounters than customers who lack trust and, therefore, may want to establish a long-term relationship [47, 48].

The mediating effect of satisfaction is deemed to have a significant role playing because positive reinforcement of expectations formulated in customers that trust the service will entail the development of loyal behaviors. This can attract further elaboration that AI chatbot personalization should moderate the trust–satisfaction relationship considerably, since it enriches the interaction quality and relevance and in turn amplifies the leverage power of trust on satisfaction. The mediated model with trust as a variable between the two main outcomes is expected to have a higher pathway when there is a high level of AI chatbot personalization because personalization strengthens both the trust–satisfaction and satisfaction–loyalty paths. Based on these theoretical foundations, it can be argued that the model's relationships are indeed grounded in past theoretical findings pertaining to human attitude and behavior toward technology, technology acceptance model, and relationship marketing. In line with this objective, the study posits the following hypotheses:

H1 Trust has a significant positive effect on AI chatbot personalization in e-commerce.

H2 AI chatbot personalization has a significant positive effect on loyalty in e-commerce.

H3 AI chatbot personalization has a significant positive effect on satisfaction in e-commerce.

H4 Loyalty has a significant positive effect on trust in e-commerce.

H5 Satisfaction has a significant positive effect on trust in e-commerce.

Methods

Study objective and sampling

This study aimed to examine the moderating effect of personalization on the trust–satisfaction–loyalty relationship within the context of AI-enabled e-commerce. To achieve this, a purposive non-probability sampling method was employed to target participants who are active users of e-commerce platforms. While Cochran's [49] formula was used to provide a baseline estimate for sample size, its assumptions—requiring random sampling—are inconsistent with the purposive sampling method used. Therefore, the calculated sample size of 385 serves only as a guideline and does not fully reflect the nature of the sampling approach. This methodological limitation, along with potential biases arising from purposive sampling, is transparently acknowledged.

Questionnaire design and scale description

The study utilized a structured survey questionnaire to measure the constructs of trust, satisfaction, loyalty, and AI chatbot personalization. The questionnaire was developed based on validated scales widely used in prior research:

- *Trust*: Items adapted from Stewart & Gosain [50] and Komiak & Benbasat [51], measuring perceived reliability, credibility, and confidence in e-commerce platforms.
- *Satisfaction*: Items based on Fang et al. [52], assessing customer contentment with prior shopping experiences, service quality, and fulfillment of expectations.
- *Loyalty*: Scale developed by Harris & Goode [53], capturing intentions for repeat purchases, willingness to recommend, and emotional attachment to the platform.
- *AI chatbot personalization*: Adapted from Zhang et al. [54], focusing on relevance, helpfulness, and accuracy of personalized recommendations provided by AI chatbots.

Each construct was measured using multiple items on a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). This scaling approach was chosen for its simplicity and widespread acceptance in similar studies, enabling straightforward interpretation and robust data analysis.

Validation and pilot testing

The questionnaire underwent multiple stages of refinement to ensure its reliability and validity. Initially, it was reviewed by three domain experts specializing in e-commerce and survey methodologies. Their feedback resulted in minor revisions to improve clarity and alignment with the study objectives. Subsequently, a pilot study involving 30 online shoppers was conducted. During this phase, participants were asked to complete the survey and provide feedback on any ambiguities or difficulties they encountered. Key insights from this pilot included adjustments to item phrasing to enhance clarity, such as simplifying technical terminology and rewording complex questions. The revised questionnaire demonstrated high internal consistency, as indicated by a Cronbach's alpha exceeding 0.8 for all constructs during pilot testing.

Data collection

The final survey was administered online using Google Forms over a two-month period. Participants were recruited via email invitations and social media platforms such as Facebook, Twitter, and LinkedIn, targeting individuals in Egypt with prior exposure to online shopping and AI chatbot personalization. A total of 786 responses were collected, of which 57 were excluded due to incomplete answers or straight-line responses, leaving a final sample size of 729 participants.

While this recruitment strategy ensured access to a diverse population of active online shoppers, it also introduced potential limitations, such as self-selection bias and underrepresentation of individuals without Internet access or limited exposure to social media. These limitations are acknowledged as they may affect the generalizability of the study findings.

Survey structure and ethical considerations

The survey was divided into two sections:

1. *Demographic information*: This section gathered data on participants' gender, age, academic background, and employment status.

2. *Construct measurement*: This section included Likert-scale items designed to measure perceptions of AI chatbot personalization, trust, satisfaction, and loyalty, as described earlier.

Ethical considerations were rigorously upheld. Participants provided informed consent, were assured of anonymity and confidentiality, and could withdraw from the study at any time. These measures ensured compliance with ethical research practices.

Data analysis and justification for methodology

The collected data were analyzed using structural equation modeling (SEM) with AMOS software. SEM was selected due to its ability to model complex relationships among latent variables, which aligns well with the study's objective of examining both direct and moderating effects. Specifically, SEM allows simultaneous evaluation of measurement and structural models, providing comprehensive insights into the trust–satisfaction–loyalty framework.

Confirmatory factor analysis (CFA) was employed to validate the measurement model and confirm the reliability, validity, and factor structure of the constructs. Alternative methods, such as simple regression or exploratory factor analysis, were deemed inadequate for this study as they cannot simultaneously assess multiple relationships or validate latent constructs. By using SEM and CFA, the methodological approach ensured rigorous testing of the hypotheses and the theoretical model.

Results

Descriptive analysis

As shown in Table 1, the study involved a total of 729 participants. Among these, 317 were male while 412 were female. The age distribution of the sample was as follows: Of the participants, 327 of them (44. 9%) were in the age of 21 to 30 years of age, 203 participants (27. 8%) of the 21 to 30 years of age, 125 participants (17. 1%) of 41 to 50 years of age and according to the education level, 91. 9% of the participants had completed bachelor's degree, and 6. 6% had completed their graduate degrees. From the aspect of the occupation, 302 respondents said they work in private organizations, 300 respondents said they work in public organizations, and 172 respondents said they are company owners, which account for 17.4 percent of the whole sample.

Confirmatory factor analysis (CFA)

As shown in Table 2 to mitigate the possibility of common method variance, we used a multi-step approach to handle the collinearity. The examination of variance inflation factors (VIFs) depicted values less than five, thus eliminating potential problems of common method variance (CMV) [55]. To assess confirmatory factor analysis (CFA) was performed to determine the reliability and validity of the measure, which provided Cronbach's alpha coefficients greater than 0. 7, indicating satisfactory reliability. In addition, both composite reliability (CR) and average variance extracted (AVE) values were above the recommended level of 0.6 and 0.5 respectively, indicating the presence of reasonable construct validity [56].

The data provided offers valuable insights into the psychometric properties of the constructs used in the study. Below is an analysis of the key aspects of reliability, validity, and potential concerns based on the figures provided:

Reliability analysis

Table 1 Frequency table for demographic variables

Variable	Categories	Frequency	Percentage
Gender	Female	317	43.5
	Male	412	56.5
Age	21–30	327	44.9
	31–40	203	27.8
	41–50	125	17.1
	Over 50	74	10.2
Academic Experience	High School	11	1.5
	Bachelor's degree	670	91.9
	Postgraduate Degree	48	6.6
Occupation	Private Organization	302	41.4
	Public Organization	300	41.1
	Business Owner/Self-Employed	127	17.4

Source: Calculations based on sample collected through surveys using SPSS software

Table 2 Model measurements of the phenomenon

Variable	Components	Loadings	Outer VIF	CA	CR	AVE
Chatbot personalized recommendations	PR1	0.884	2.100	0.849	0.908	0.767
	PR2	0.875	2.091			
	PR3	0.868	1.989			
Loyalty	L1	0.772	2.398	0.926	0.936	0.529
	L2	0.815	3.097			
	L3	0.751	2.093			
	L4	0.683	2.057			
	L5	0.700	1.988			
	L6	0.735	2.277			
	L7	0.763	2.308			
	L8	0.693	2.116			
	L9	0.741	2.159			
	L10	0.743	2.349			
	L11	0.644	2.130			
	L12	0.762	2.337			
	L13	0.633	2.111			
Trust	T1	0.758	1.747	0.857	0.894	0.586
	T2	0.830	2.988			
	T3	0.795	3.049			
	T4	0.778	2.134			
	T5	0.629	1.650			
	T6	0.789	2.015			
Satisfaction	S1	0.864	2.523	0.866	0.910	0.716
	S2	0.886	2.675			
	S3	0.867	2.265			
	S4	0.762	1.611			

Source: Calculations based on sample collected through surveys using SmartPLS

- Cronbach's Alpha (CA): All constructs report CA values greater than 0.7 (e.g., Chatbot Personalized Recommendations = 0.849, Loyalty = 0.926, Trust = 0.857, Satisfaction = 0.866), indicating high internal consistency across items within each construct.
- Composite Reliability (CR): CR values exceed 0.7 for all constructs, confirming that the items collectively provide a reliable measure of their respective constructs.

Construct validity

- Average Variance Extracted (AVE): AVE values for all constructs are above 0.5 (e.g., Chatbot Personalized Recommendations = 0.767, Loyalty = 0.529, Trust = 0.586, Satisfaction = 0.716), meeting the threshold for convergent validity. This indicates that the items within each construct adequately explain the variance of the underlying factor.
- Discriminant Validity: Although not explicitly mentioned in the provided text, the Fornell–Larcker criterion or other measures should be used to ensure discriminant validity. Given the AVE values, the constructs are likely distinct, but this needs explicit confirmation.

Collinearity concerns

- Variance inflation factors (VIFs): All VIF values are less than 5, mitigating concerns about multicollinearity. This ensures that the predictor variables do not excessively overlap, which could distort regression coefficients or SEM outcomes.

Item redundancy and distribution

Table 3 Fornell–Larcker criterion for measuring discriminant validity

	AI Chatbot	Loyalty	Satisfaction	Trust
AI Chatbot	0.876			
Loyalty	0.557	0.728		
Satisfaction	0.659	0.545	0.846	
Trust	0.651	0.529	0.721	0.766

Source: Calculations based on sample collected through surveys using SmartPLS

- Chatbot Personalized Recommendations: Three items (PR1, PR2, PR3) have high loadings (≥0.868), indicating strong contributions to the construct. With an AVE of 0.767 and CR of 0.908, this construct is both reliable and valid.
- Loyalty: Thirteen items are used to measure Loyalty, with loadings ranging from 0.633 to 0.815. The wide range and redundancy indicated by consistently high CA and CR suggest that some items could be eliminated without compromising reliability or validity.
- Trust and Satisfaction: Both constructs use six and four items, respectively, with high loadings and appropriate reliability metrics. These constructs appear well-measured without evident redundancy.

As indicated in Table 3, the Fornell–Larcker criterion was employed to establish discriminant validity. In accordance with the recommendation by Afthanorhan et al. [57], the square root of the average variance extracted (AVE) exceeded the correlation coefficients with other constructs.

Structural equation modelling (SEM)

The investigation of the relationships illustrated in Fig. 2 was conducted using structural equation modeling (SEM).

The findings presented in Table 4 established that quality of the AI chatbot service had a positive and significant effect on loyalty ($\beta = 0.297$, $p < 0.001$) as depicted in Hypothesis 2. Satisfaction also had a positive influence on loyalty ($\beta = 0.183$) at 99% level of confidence which

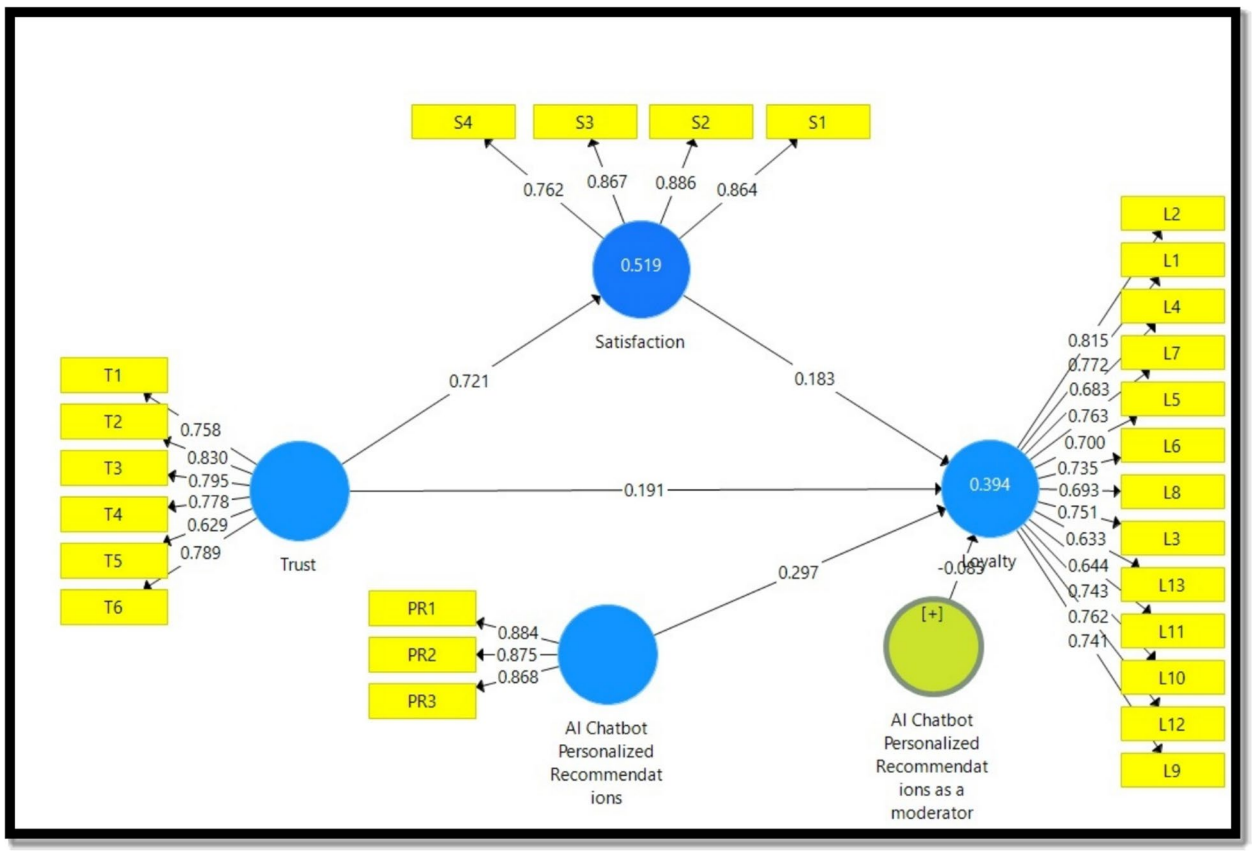


Fig. 2 Structural equation model for phenomenon. *Source:* Calculations based on sample collected through surveys using SmartPLS

Table 4 Path coefficients of the model

Hypothesis		Original sample	Standard deviation	*P* values	Decision
	AI Chatbot Personalized Recommendations—> Loyalty	0.297	0.039	0.000	Accepted
H1	Satisfaction—> Loyalty	0.183	0.052	0.000	Accepted
H2	Trust—> Loyalty	0.191	0.051	0.000	Accepted
H3	Trust—> Satisfaction	0.721	0.022	0.000	Accepted
Mediating Effects					
H4	Trust—> Satisfaction—> Loyalty	0.132	0.038	0.001	Accepted
Moderating Effects					
H5	Personalized Recommendations as a moderator in relationship between Trust and Loyalty	– 0.085	0.025	0.001	Accepted

Source: Calculations based on sample collected through surveys using SmartPLS

Table 5 Model evaluation metrics

	SSO	SSE	Q^2	R Square	R Square Adjusted
Loyalty	9477.000	7617.886	0.196	0.394	0.391
Satisfaction	2916.000	1840.897	0.369	0.519	0.519

Source: Calculations based on sample collected through surveys using SmartPLS
SRMR = 0.084, d_ULS = 2.484, d_G = 1.130, Chi-Square = 4182.524, NFI = 0.697

shows that satisfaction partially mediated the relationship between trust and loyalty. The path coefficients of the mediating effects were significant at the 0. 001 level which implies that satisfaction partially explain the relationship. The findings also showed that trust had a positive effect on both loyalty (β = 0. 191) and satisfaction (β = 0. 721) and the level of confidence was 99%.

In addition, the AI chatbot's ability to provide personalized recommendations weakens the correlation between trust and satisfaction (β = − 0. 085). This indicates that AI chatbot personalized recommendations moderate the relationship between Trust and Satisfaction. The value of the coefficient and direction explains how the AI chatbot personalized recommendations influence the trust and satisfaction relationship. In particular, the role of trust in the context of the AI chatbot's personalized recommendations is to decrease the coefficient of loyalty from 0. 287 to 0. 191. It also emerged that there was a 5% improvement in the R squared coefficient when the moderator was incorporated into the model, which shows that the personalized recommendations have a positive effect on the model's performance. In conclusion, the findings of this study provide strong evidence that personalized recommendations can help in managing the relationship between trust, satisfaction and loyalty thus offering useful directions for exploring the efficacy of personalization in marketing.

As indicated in Table 5, the empirical model explained 39 percent of the variance in the score on the survey questionnaire. This study shows that a 1% increase in the independent variable significantly increases the dependent variable loyalty and that 51 % of that boost can be attributed to the impact of brand affect. 9% in satisfaction. Moreover, Q2 and SRMR as the measures of the model fit to the data provided also revealed the acceptable levels of fit according to Hair et al. [58]. Hence, the study established trust as a significant and positive driver of remains of consumer loyalty and satisfaction. Satisfaction was thus found to be mediating, in the sense that it was at the center of the independent variables and the dependent variable of the study, being loyalty. Conversely, Chatbot's personalization service remained an active participant in the observed relationships as a moderator. He proposed a highly accurate model showing that it was able to explain a vast majority of the phenomenon witnessed in customer loyalty.

Finally, the paper's results present the statistically significant significance of the investigated hypotheses providing insightful data about the tested interdependencies between the trust, satisfaction, loyalty, and AI-based, personalized recommendations. These coefficients show the strength and relevance of these relationships, based on the paths coefficients, R^2 values, and significance values for hypotheses testing. These results help elucidate the dynamics between trust, satisfaction, and loyalty, and the role of personalized AI tools in moderating these interactions.

The relationship between trust, satisfaction, and loyalty is central to the study. Trust positively influences satisfaction (β = 0.721) and loyalty (β = 0.191), while satisfaction mediates the link between trust and loyalty (β = 0.132). These findings confirm the hypothesized mediation effect and underscore the critical role of satisfaction in translating trust into loyalty. This suggests that enhancing customer satisfaction can significantly bolster loyalty, especially when trust is established as a foundation.

The presence of the artificial intelligence-generated recommendations layer transforms the process into one that is much more complex. The analysis reveals that

personalization increases R^2 by 5%, proving that it can contribute significantly to the entire model explanatory capability. However, the negative moderation effect (−0.085) means that personalization perhaps has a potential to weaken the trust–satisfaction relationship and therefore highlights the need to keep on designing AI systems. The authors of this study make a crucial inference which says that although the role of recommendations for enhancing satisfaction and loyalty is beyond doubt, there is equal probability of negative consequence of poor personalization on trust.

These statistical insights align with theoretical frameworks such as the Trust-Commitment Theory and Expectation-Confirmation Theory, providing a robust basis for interpreting the findings. The study highlights the potential of AI-driven personalization to optimize trust dynamics in e-commerce and offers practical guidance for businesses to design user-centric systems that strengthen trust, satisfaction, and loyalty.

Discussion

This research contributes practical implications for e-commerce companies and AI makers by presenting an understanding of how to apply state-of-the-art artificial intelligence techniques to e-commerce organizations. To e-commerce companies, the highlights of the study underscore the need and possibility to incorporate AI tools into the business and operations to work on the overall satisfaction of the users. It means that by using AI technologies, like recommendation systems, personalized advertising, and automated client services the business can be more in touch with consumer wants. It also aligns with concerns for greater interaction, as these tools do not only enhance outputs but supply customized approaches that are aligned to user inclinations. For example, using AI to put in place decision support tools such as predictive analytics will go a long way in enabling e-commerce businesses to forecast customer needs, manage stocks and operate efficiently at lower costs. This correlates with the current shift by the consumers for quicker, efficient, and personalized shopping services.

In terms of its implications for the development of AI technology, the study serves to support the belief of developers that attention should be paid to the algorithms that must accurately and fairly solve a given problem while being easily explained to a bystander. For the results raise an imperative question for us to minimize the biases and make sure the AI technologies in commercial environments are used fairly and justly. It is now imperative for developers to work hard toward formulating algorithms that are efficient but also, understandable, ensuring that anyone interested, gets to know how the model arrived at such a particular decision. In addition, as new e-commerce issues come to the foreground, the issues like improvement of search experience, optimization of recommendations and even more sophisticated try-on options, which are still in a prototype level currently, require progress in natural language processing as well as computer vision. To the extent that AI is designed with human-centered elements in mind, developers can retain technical excellence while simultaneously improving usability.

From a wider perspective, integration of AI with e-commerce has potential for changing the face of the industry. But, it also presents issues that affect privacy, solve ethical questions, and uphold consumer confidence. It became clear that particular attention needs to be paid to how businesses and developers cooperate to implement AI so that the solutions are not only innovative but also compliant with rules and norms society accepts. This involves arriving at satisfactory policies for data control and ensuring that consumer data are secured to the greatest extent possible yet also extracting the best value from applications of AI.

Consequently, the outcomes of the study give the e-commerce and AI industry a guideline to use artificial intelligence to unlock change. By being grounded in specific use cases, as well as the moral dimension of the problem, stakeholders can design systems which produce measurable positive value, thus enabling the positive evolution of the digital economy in a way which is more in tune with the needs of consumers. It is crucial to improving the company's position in a rapidly AI-saturated environment in order to remain relevant.

Implications

Theoretical implications

This study also provides an essential theoretical contribution to the understanding to the moderating role of personalized recommendations by the use of AI in the trust–satisfaction–loyalty relationship in e-commerce. The study helps' to understand the effect of the AIOPR on key aspects of customer experience and their interplay, contributing to broadening the theoretical knowledge about the trust–satisfaction–loyalty nexus. That way the research reveals nuances of the relationship between trust and satisfaction, which are mediated by AI, and how these factors look in the context of customer loyalty in the sphere of e-commerce.

From a theoretical viewpoint, the research enhances the conceptualization and measurement of trust and loyalty through demystifying the dynamics of these constructs within the context of the AI-driven digital commerce environment. Most especially, it explains how satisfaction is a mediator and how personalization is a moderator in the consumer relationship in trust to loyalty conversion through digital facilitation [8, 9]. In placing AI-based personalization at the core of this work, insights into modern

consumer decision-making processes and their interactions with intelligent processes are obtained.

Their incorporation together with well-developed AI elements such as recommendation systems also enriched the theoretical framework of consumer behavior theories as applied to e-commerce. The study allocates these variables into conventional models to address the increasing intricacy of consumers' cognitive processes, as well as the escalating imperative for theories to expand commensurately with technology. This also revolutionizes the applicability of the trust–satisfaction–loyalty models in present-day environments and opens channel for further examination of the relationship between AI and consumer conduct in the future studies.

In addition, this study extends the existing trust–satisfaction–loyalty model by considering the mediating effect of satisfaction and the moderating role of personalization of recommendation. AI-enriched features, such as personalized recommendations, offer deeper insights into how trust and satisfaction jointly shape customer loyalty behavior. This approach provides a more dynamic perspective on the consumer decision-making process, enabling the development of theoretical models that are better aligned with the technological realities of today's e-commerce landscape [28, 37].

Thus, the study makes a notable contribution by extending existing theoretical frameworks to incorporate AI-driven personalization, thereby addressing the growing complexities of consumer experiences in e-commerce. By emphasizing the mediating and moderating roles of satisfaction and personalized recommendations, respectively, the research sets the stage for the formulation of new models that capture the evolving dynamics of trust, satisfaction, and loyalty in AI-enabled e-commerce environments.

Practical implications

Therefore, for e-commerce platforms and marketer, this research and finding of the moderating effect of personalization with the trust–satisfaction–loyalty mediation model will go a long way to improve the use of AI technology in building consumer trust, satisfaction, and consequent loyalty. Time and methods of implementing AI features should be determined so that entrepreneurs get closer to buyers and improve their interaction with them.

This research empowers online retailers and marketing specialists to perform analytical and strategic application of AI-driven recommendations. For example, nowadays using recommendation systems is widespread and companies like Amazon and Netflix offer products or content based on the user's history in their website and past purchases. With these algorithms best suited to respond to customer needs, businesses can build customer trust, boost satisfaction, and improve the retention of its customer base thereby growing its user database [17, 24]. In parallel, the "Discover Weekly" playlist of Spotify shows how with the use of personalized artificial intelligence systems, users are most likely to engage due to the feel of the products recommending the items thus cultivating loyalty.

The outcomes of this study also highlight the importance of addressing potential difficulties in the customer experience by prioritizing transparency, usefulness, and trustworthiness in AI-driven systems. For example, transparency features, such as providing explanations for why a specific product is recommended, can enhance trust and satisfaction. Google's "Why This Ad?" feature allows users to see why they are being targeted with a specific ad, improving transparency and making the interaction feel more ethical and user-centric [30, 31, 34]. Such practices should be also followed in e-commerce to build trust and to make consumers to accept AI attributes as positive.

Accompanying the specific impact factors, it is possible to understand the role of mediating and moderating effects studied in this research, so that e-commerce practitioners can adjust the targeted advertising and marketing plans. For instance, Zalando, a European fashion platform employs the use of artificial intelligence in effecting segmented retailing to its customers on the basis of the customized browsing pattern of its customers. This makes it easy for the authors to adjust the recommended products in real-time, which ultimately leads to increased repurchasing rates for the platform and helps it retain its competitive advantage over other market players [38, 39]. Personalized marketing campaigns that leverage customer data insights can significantly strengthen relationships and foster loyalty.

Furthermore, the study findings can serve as a reference for e-commerce platforms to develop more accurate and effective recommendation algorithms. For example, Alibaba's "Personalized Homepage" uses AI to provide a unique interface for every user, prioritizing products that are most relevant to their interests and recent activity. Such a continuous presence to fine tune recommendations helps in increasing customer retention and increase profit by ensuring that the products made available suit the users desires [30, 31, 43]. Drawing from the ongoing debates on trust and transparency in the AI systems, the research recommends that the organizations take effort in ensuring the consumer and the employees understood the workings of the system. For instance, factsheets containing information on how the particular AI-based recommendation method works, for instance, the outreach programs that show logical rationalization of each recommendation made by systems like Spotify—reduces the perceived risk and tension and increases user participation and confidence [36, 38]. Ultimately, it means that through increasing the level of

understanding between people about the usage of these technologies, the acceptance and effectiveness of the AI-powered features would experience the same boost. At the same time, enhanced and even personalized chatbots and virtual assistants must be viewed as one of the primary areas of Personalization for e-commerce companies. Other firms, for instance Sephora beauty brands and department stores, have integrated chatbots which can easily recommend beauty products to users based on the inputs entered. These chatbots ensure high levels of customer satisfaction since potential customers can receive support at any stage of their customer journey and form lifelong patronage relationships [34, 37]. Consumer trust and the success of e-commerce platforms also depend heavily on implementing robust data privacy and security measures. For example, Apple's "App Tracking Transparency" feature, which gives users control over their data privacy, has demonstrated the importance of transparency in fostering trust. Similarly, e-commerce platforms should employ strong encryption and transparent data policies to address concerns about AI and reassure customers [40, 41].

Last but not least, the advantages related to the usage of AI in delivering more personalized content have to consider the cultural aspects. Businesses have to invest in market research in order to meet the needs of the various categories of consumers they have and to overcome the problem of algorithmic prejudice. For instance, Netflix personalization provides geolocation-specific content like Indian movies like Bollywood or South Korean series like K-dramas and makes sure to render global satisfaction to consumers [42, 44]. This cultural sensitivity does not only improve satisfaction but also boost brand loyalty across different customers' categories.

Last, the applied management implications based on the presented research help e-commerce organizations to utilize AI tools and applications as tools and enablers for improvement of customer relationship strategies and fostering sustainability in the context of e-business. With specific factors like recommendations, clear algorithms, and culturally appropriate solutions, e-commerce platforms can easily not only meet, but also top customers' expectations thereby guaranteeing success where and when competition is rife.

Conclusion

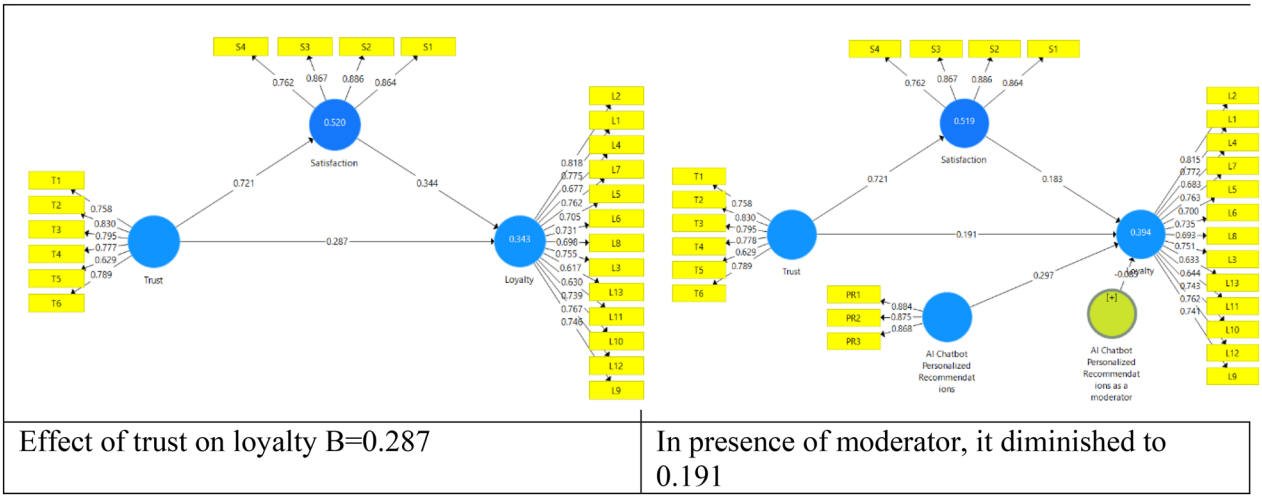
This study provides valuable insights into the moderating role of personalized recommendations, an AI-driven feature, in shaping the trust–loyalty relationship within e-commerce. However, there are several limitations that should be acknowledged. First, the cross-sectional design of the study limits its ability to establish causative relationships between the variables or track their development over time. While the research effectively captures a snapshot of the trust–loyalty dynamic and the impact of personalized recommendations, a longitudinal approach would allow for a deeper understanding of how trust and loyalty evolve in the context of AI-driven e-commerce. Future research could address this limitation by conducting longitudinal studies to monitor changes in trust, satisfaction, and loyalty over time, particularly as consumers' interactions with AI-driven features grow more sophisticated.

Second, the study's focus is limited to personalized recommendations as the sole AI-driven feature impacting the trust–loyalty connection. While personalized recommendations are undoubtedly significant, they represent just one aspect of AI's influence on the consumer experience. Other AI features, such as chatbots, virtual assistants, predictive analytics, and dynamic pricing, may also play critical roles in shaping trust, satisfaction, and loyalty. Exploring these additional features could provide a more comprehensive understanding of how AI transforms the customer journey in e-commerce. Future research should expand the scope to investigate the impact of a wider range of AI technologies on consumer behavior, enabling businesses to better understand and leverage the full spectrum of AI capabilities.

The research also has a limitation of not doing comparison between cultures. And the study was done in Egypt this setting gives important information concerning the Egyptian market but excludes the cultural aspects concerning the AI-based personalization. How consumers act, whether or not they trust an AI system, and how they react to personalization will all depend on cultural differences in norms of privacy, and with a technology literacy gap. Subsequent research should focus on comparing different countries to familiarize with how the cultural settings affect the efficiency of the AI characteristics in the international sphere, mostly in e-commerce. This would help the concerned business to come up with better strategies which are acceptable in the different cultures of the customers.

Finally, this study increases our understanding of the moderating effect of personalized recommendations in the trust–satisfaction–loyalty chain but allows for several limitations: cross-sectional study design, singular focus on one element of AI technology, and no comparison between different cultures. As a result, the future research needs to incorporate more extended research measures of different nature, examine a wider variety of attributes of AI technologies, and compare consumers from different cultural backgrounds. Subsequently, it is possible for future studies to come up with a detailed picture concerning the contribution of AI in improving the level of consumer trust, satisfaction, and loyalty in the e-commerce environment, by addressing the aforementioned research gaps.

Appendix



Effect of trust on loyalty B=0.287	In presence of moderator, it diminished to 0.191

Abbreviations

AI	Artificial intelligence
SEM	Structural equation modelling
SPSS	Statistical package for social sciences
CFA	Confirmatory factor analysis
CA	Cronbach alpha
CR	Composite reality
AVE	Average variance extracted
VIFs	Average variance factors
CMB	Common method variance

Acknowledgements
The authors express gratitude to the editorial board and the reviewers for their invaluable support and guidance throughout this research.

Author contributions
All authors have equally worked in this research paper.

Funding
This research received no financial funding.

Availability of data and materials
The data and materials used in this study are available upon reasonable request from the corresponding author.

Declarations

Ethics approval and consent to participate
The study was conducted following ethical guidelines, with prior approval obtained from Cairo university institutional ethics review board, and informed consent was secured from all participants involved.

Consent for publication
All authors have reviewed and provided consent for the publication of this work.

Competing interests
The authors declare no competing interests related to this study.

Author details
[1]Newgiza University (NGU), 6th of October, Egypt. [2]King Salman International University (KSIU), El Tor, Egypt.

Received: 10 September 2024 Accepted: 10 March 2025
Published online: 10 April 2025

References

1. Li MW, Teng HY, Chen CY (2020) Unlocking the customer engagement-brand loyalty relationship in tourism social media: the roles of brand attachment and customer trust. J Hosp Tour Manag 44:184–192
2. Paparoidamis NG, Katsikeas CS, Chumpitaz R (2019) The role of supplier performance in building customer trust and loyalty: a cross-country examination. Ind Mark Manag 78:183–197
3. Kamal M, Himel AS (2023) Redefining modern marketing: an analysis of AI and NLP's influence on consumer engagement, strategy, and beyond. Eigenpub Rev Sci Technol 7(1):203–223
4. Khrais LT (2020) Role of artificial intelligence in shaping consumer demand in e-commerce. Future Internet 12(12):226
5. Vidhya V, Donthu S, Veeran L, Lakshmi YS, Yadav B (2023) The intersection of AI and consumer behavior: predictive models in modern marketing. Remitt Rev 8(4):2410–2424
6. Necula SC, Păvăloaia VD (2023) AI-driven recommendations: a systematic review of the state of the art in e-commerce. Appl Sci 13(9):5531
7. Qin Y, Yin S and Liu F (2023) Navigating criminal responsibility in the digital marketplace: implications of network-neutral help behaviour and beyond-5G networks in e-commerce transactions. J Knowl Econ. 1–29.
8. Soleimani M (2022) Buyers' trust and mistrust in e-commerce platforms: a synthesizing literature review. IseB 20(1):57–78
9. Jiang C, Rashid RM, Wang J (2019) Investigating the role of social presence dimensions and information support on consumers' trust and shopping intentions. J Retail Consum Serv 51:263–270
10. Sharma SK, Sharma M (2019) Examining the role of trust and quality dimensions in the actual usage of mobile banking services: an empirical investigation. Int J Inf Manage 44:65–75
11. Faraoni M, Rialti R, Zollo L, Pellicelli AC (2019) Exploring e-loyalty antecedents in B2C e-commerce: empirical results from italian grocery retailers. Br Food J 121(2):574–589
12. Pekovic S, Rolland S (2020) Recipes for achieving customer loyalty: a qualitative comparative analysis of the dimensions of customer experience. J Retail Consum Serv 56:102171
13. Slack N, Singh G, Sharma S (2020) The effect of supermarket service quality dimensions and customer satisfaction on customer loyalty and disloyalty dimensions. Int J Qual Serv Sci 12(3):297–318
14. Darmawan D (2019) The effect of customer satisfaction on trust and customer loyal. Manag Account Res J. 3(2).
15. Vijay ST, Prashar S, Sahay V (2019) The influence of online shopping values and web atmospheric cues on e-loyalty: mediating role of e-satisfaction. J Theor Appl Electron Commer Res 14(1):1–15
16. Chinchanachokchai S, Thontirawong P, Chinchanachokchai P (2021) A tale of two recommender systems: the moderating role of consumer expertise on artificial intelligence based product recommendations. J Retail Consum Serv 61:102528

17. Arora S, Athavale VA, Maggu H and Agarwal A (2020) Artificial intelligence and virtual assistant—working model. In: Mobile Radio Communications and 5G Networks: Proceedings of MRCN 2020 (pp. 163–171). Singapore: Springer Singapore.
18. Malhotra G, Kharub M (2025) Elevating logistics performance: harnessing the power of artificial intelligence in e-commerce. Int J Logist Manag 36(1):290–321
19. Vashishth TK, Sharma KK, Kumar B, Chaudhary S and Panwar R (2025) Enhancing customer experience through ai-enabled content personalization in e-commerce marketing. Adv Dig Market Era Artif Intell. 7–32.
20. Bhardwaj S, Sharma N, Goel M, Sharma K and Verma V (2025) Enhancing customer targeting in e-commerce and digital marketing through AI-driven personalization strategies. Adv Dig Market Era Artif Intell. 41–60.
21. Chakraborty T, Sharada VS and Sai SDD (2025) Transactions to relationship: customers engagement in the digital age. In: Managing Customer-Centric Strategies in the Digital Landscape (pp. 25–50). IGI Global.
22. Basuvaraj M and Rastogi K (2025) Illuminating the convergence of artificial intelligence (AI) and business intelligence (BI) in e-commerce and fin-tech in India. In: AI-Powered Business Intelligence for Modern Organizations (pp. 243–264). IGI Global.
23. Ameen N, Hosany S, Paul J (2022) The personalisation-privacy paradox: consumer interaction with smart technologies and shopping mall loyalty. Comput Hum Behav 126:106976
24. Patel B (2023) The future of mortgages: evaluating the potential of blockchain and generative AI for reducing costs and streamlining processes.
25. Nadeem W, Khani AH, Schultz CD, Adam NA, Attar RW, Hajli N (2020) How social presence drives commitment and loyalty with online brand communities? The role of social commerce trust. J Retail Consum Serv 55:102136
26. Rather RA (2019) Consequences of consumer engagement in service marketing: an empirical exploration. J Glob Mark 32(2):116–135
27. Aslam W, Hussain A, Farhat K, Arif I (2020) Underlying factors influencing consumers' trust and loyalty in e-commerce. Bus Perspect Res 8(2):186–204
28. Khan RU, Salamzadeh Y, Iqbal Q, Yang S (2022) The impact of customer relationship management and company reputation on customer loyalty: the mediating role of customer satisfaction. J Relation Market 21(1):1–26
29. Borraz-Mora J, Hernandez-Ortega B, Melguizo-Garde M (2020) The influence of generic-academic competences on satisfaction and loyalty: the view of two key actors in higher education. J High Educ Policy Manag 42(5):563–578
30. Dwivedi YK, Hughes L, Ismagilova E, Aarts G, Coombs C, Crick T, Duan Y, Dwivedi R, Edwards J, Eirug A, Galanos V (2021) Artificial Intelligence (AI): multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. Int J Inf Manag 57:101994
31. Dwivedi YK, Ismagilova E, Hughes DL, Carlson J, Filieri R, Jacobson J, Jain V, Karjaluoto H, Kefi H, Krishen AS, Kumar V (2021) Setting the future of digital and social media marketing research: perspectives and research propositions. Int J Inf Manag 59:102168
32. Cheng Y, Jiang H (2022) Customer–brand relationship in the era of artificial intelligence: understanding the role of chatbot marketing efforts. J Product Brand Manag 31(2):252–264
33. Hu X, Chen X, Davison RM (2019) Social support, source credibility, social influence, and impulsive purchase behavior in social commerce. Int J Electron Commer 23(3):297–327
34. Ameen N, Tarhini A, Reppel A, Anand A (2021) Customer experiences in the age of artificial intelligence. Comput Hum Behav 114:106548
35. Ifekanandu CC, Anene JN, Iloka CB, Ewuzie CO (2023) Influence of artificial intelligence (AI) on customer experience and loyalty: mediating role of personalization. J Data Acquis Process 38(3):1936
36. de Fine Licht K, de Fine Licht J (2020) Artificial intelligence, transparency, and public decision-making: why explanations are key when trying to produce perceived legitimacy. AI & Soc 35:917–926
37. Kathuria S, Rana S (2023) Linking Customer E-Service Quality with Artificial Intelligence-Based Business Environment. Artificial Intelligence in Customer Service: The Next Frontier for Personalized Engagement. Springer International Publishing, Cham, pp 259–279
38. Chen Q, Lu Y, Gong Y and Xiong J (2023) Can AI chatbots help retain customers? Impact of AI service quality on customer loyalty. Internet Research.
39. Fan H, Han B, Gao W (2022) (Im) Balanced customer-oriented behaviors and AI chatbots' Efficiency-Flexibility performance: The moderating role of customers' rational choices. J Retail Consum Serv 66:102937
40. Deng G, Zhang J, He L and Xu Y (2023) Research on the impact of e-commerce platform's AI resources on seller opportunism: a cultivational governance mechanism. Nankai Business Review International, (ahead-of-print).
41. Chen JS, Le TTY, Florence D (2021) Usability and responsiveness of artificial intelligence chatbot on online customer experience in e-retailing. Int J Retail Distrib Manag 49(11):1512–1531
42. Kushwaha AK, Kumar P, Kar AK (2021) What impacts customer experience for B2B enterprises on using AI-enabled chatbots? Insights from Big data analytics. Ind Mark Manag 98:207–221
43. Prentice C, Weaven S, Wong IA (2020) Linking AI quality performance and customer engagement: the moderating effect of AI preference. Int J Hosp Manag 90:102629
44. Jiang K, Qin M, Li S (2022) Chatbots in retail: How do they affect the continued use and purchase intentions of Chinese consumers? J Consum Behav 21(4):756–772
45. Nguyen ND, Truong NA, Dao PQ, Nguyen HH (2025) Can online behaviors be linked to mental health? Active versus passive social network usage on depression via envy and self-esteem. Comput Hum Behav 162:108455
46. Efendy,DK and Bharata W (2025) Pengukuran perilaku pengguna produk apple menggunakan Perspektif expectation confirmation theory DAN flow theory. J Econ, Bus Account (Costing). 8(1): 48–57.
47. Røynesdal ØB, Roberts GC, Pereira HV, Jelsma JG, Wyke S, Andersen E, Gray CM, Hunt K, Silva MN, van Nassau F, Sørensen M (2025) Fostering health behaviour change in overweight male football fans through the European fans in training (EuroFIT) program: a self-determination theory perspective. Psychol Sport Exercise 76:102742
48. Wang X, Howard JL, Zhong L (2025) Why do perfectionists procrastinate (or not)? Exploring the interaction between perfectionism dimensions through self-determination theory. Appl Psychol 74(1):e12563
49. Cochran WG (1963) Sampling Techniques. Wiley, New York
50. Stewart KJ and Gosain S (2006) The impact of ideology on effectiveness in open source software development teams. Mis Quart. 291–314.
51. Komiak SY and Benbasat I (2006) The effects of personalization and familiarity on trust and adoption of recommendation agents. MIS quarterly. 941–960.
52. Fang Y, Qureshi I, Sun H, McCole P, Ramsey E, Lim KH (2014) Trust, satisfaction, and online repurchase intention. MIS Q 38(2):407-A9
53. Harris LC, Goode MM (2004) The four levels of loyalty and the pivotal role of trust: a study of online service dynamics. J Retail 80(2):139–158
54. Zhang T, Agarwal R, Henry CL Jr (2011) The value of IT-enabled retailer learning: personalized product recommendations and customer store loyalty in electronic markets. MIS Q 35(4):859–881
55. Shrestha N (2020) Detecting multicollinearity in regression analysis. Am J Appl Math Stat 8(2):39–42
56. Ribeiro OMPL, Vicente CMFDB, Sousa CN, Teles PJFC, Trindade LDL, Martins MMFPDS, Cardoso MFPT (2021) Scale for the environment evaluation of professional nursing practice: construct validation. J Nurs Manag 29(6):1809–1818
57. Afthanorhan A, Ghazali PL and Rashid N (2021) Discriminant validity: a comparison of CBSEM and consistent PLS using Fornell & Larcker and HTMT approaches. In Journal of Physics: Conference Series (Vol. 1874, No. 1, p. 012085). IOP Publishing.
58. Hair JF, Hult GTM, Ringle CM, Sarstedt M, Thiele KO (2017) Mirror, mirror on the wall: a comparative evaluation of composite-based structural equation modeling methods. J Acad Mark Sci 45:616–632

Publisher's Note